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EXAMINER

HARRINGTON, ALICIA M

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2873

DATE MAILED: 01/12/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/681,308	Applicant(s) LI ET AL.	
	Examiner Alicia M Harrington	Art Unit 2873	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 October 2003 and 16 November 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-55 is/are pending in the application.
- 4a) Of the above claim(s) 46-55 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-45 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>1104</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of claims 1-45 in the reply filed on 11/12/04 is acknowledged.
2. Claims 46-55 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 11/12/04.

Information Disclosure Statement

3. The information disclosure statement filed on 11/16/04 has been considered by the Examiner.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
5. Claims 31-32, 34,38 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 31 recites the limitation "said wafer" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 32 recites the limitation "said wafer" in line 2. There is insufficient antecedent basis for this limitation in the claim.

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Claim 34 depends from claims 33. Claim 33 defined a first, second and third size of the micro lens where the second micro lens is larger in size than the first. Claim 34 recites, " the first, second and third size are equal". The Examiner is unclear as to how the lens are equal and one is larger the other. Thus, applicant fails to particularly point out and distinctly claims what applicant regards as the invention and this renders the claims indefinite.

Claim 38 recites the limitation "said wafer" in line 2. There is insufficient antecedent basis for this limitation in the claim

Claims 31-32,38 will be examined as best understood by the Examiner.

Claims 34 will not be treated on the merits.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 24- 27, 30-33are rejected under 35 U.S.C. 102(b) as being anticipated by Hokari (US 5,493,143).

Regarding claim 24, Hokari discloses a semiconductor-based imager, comprising:

a substrate(1) having pixel cells formed thereon (see col. 3, lines 40-50), each with a see(2);

a micro-lens array (9), comprising:

a first plurality of first micro-lenses each having a first size (for example 9G); and

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a second plurality of second micro-lenses each having a second size (for example 9R- height or 9B-surface area; see col. 6, lines 40-61) larger than said first size (9G-see figures 8-11); wherein said second micro-lenses (for example 9B) are adapted to collect a greater amount of light than said first micro-lenses (9G- the Blue lens is larger surface area-see for example figure 11).

Regarding claim 25, Hokari discloses the semiconductor-based imager of claim 24, wherein said first (9G) and said second (for example 9B) micro-lenses each exhibit a similar focal length (In one embodiment, the micro lens material is wavelength selective and the light for individual wavelengths are focused at the photo sensor- see figures 9, 10e and 11- col. 5, lines 15-20 and 50-55).

Regarding claim 26, Hokari discloses the semiconductor-based imager of claim 25, wherein said focal length extends to said photo sensors (see figure 9 and col. 5, lines 15-20).

Regarding claim 27, Hokari discloses the semiconductor-based imager of claim 24, wherein a focal length of the plurality of first micro-lenses is adjusted for a first color signal, and wherein a focal length of the plurality of second micro-lenses is adjusted for a second color signal (In the embodiment of figure 8, each lens had a different curvature and thickness-see col. 5, lines 25-50).

Regarding claim 30, Hokari discloses the semiconductor-based imager of claim 24, further comprising a color filter array (20G, 20R, 20B) positioned over said pixel cells (see figure 9; col. 5, lines 55-65).

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Regarding claim 31, Hokari discloses the semiconductor-based imager of claim 30, wherein said color filter (20G, 20R, 20B) array is positioned between said micro-lens array (9) and said wafer (1).

Regarding claim 32, Hokari discloses the semiconductor-based imager of claim 24, further comprising a light shield (7) positioned between said micro-lens array (9) and said wafer (1).

Regarding claim 33, Hokari discloses the semiconductor-based imager of claim 24, wherein said micro-lens array further comprises a third plurality of third micro-lenses each having a third size (for example 12 R).

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

9. Claims 1-3, 6,7,10-16,36-39,43-45 are rejected under 35 U.S.C. 102(e) as being anticipated by Shizukuishi (US 6,734,031).

Regarding claim 1, Shizukuishi discloses a micro-lens array, comprising:

a first set of micro-lenses comprising a plurality of first micro-lenses (for example 12G) each having a first size (see col. 4, lines 3-10 and 40-52; col. 5, lines 5-12; col. 11, lines 35-45; figures 1a and 3); and

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a second set of micro-lenses comprising a plurality of second micro-lenses (for example **12 B**) each having a second size (see col. 4, lines 3-10 and 40-52; col. 5, lines 14-17; col. 11, lines 35-45; figures 1a and 3);

wherein at least one of said plurality of first micro-lenses at least abuts at least one of said plurality of second micro-lenses (see col. 3, lines 55-63; col. 5, lines 5-12 and col. 6, lines 5-10).

Regarding claim 2, Shizukuishi discloses the micro-lens array of claim 1, further comprising a third set of micro-lenses (for example **12R**) comprising a plurality of third micro-lenses each having a third size (see col. 5, lines 14-19 and col. 11, lines 35-45).

Regarding claim 3, Shizukuishi discloses the micro-lens array of claim 2, wherein said first, second, and third sizes are equal to each other (Shizukuishi teaches the micro lenses are only spectrally differentiated-see col. 11, lines 35-45).

Regarding claim 6, Shizukuishi discloses a micro-lens array, comprising:

a first set of micro-lenses (12G) comprising a plurality of first micro-lenses;

a second set of micro-lenses (12B) comprising a plurality of second micro-lenses; and

a third set of micro-lenses (12R) comprising a plurality of third micro-lenses; wherein said first micro-lenses at least abut said second and third micro-lenses (see figure 1a; col. 3, lines 55-63; col. 5, lines 5-12; col. 6, lines 5-10).

Regarding claim 7, Shizukuishi discloses the micro-lens array of claim 6, wherein said first micro-lenses have a first size and said second micro-lenses have a second size, said second size being no smaller than said first size (Shizukuishi teaches the micro lenses are only spectrally differentiated-see col. 11, lines 35-45-see figure 1a).

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Regarding claim 10, Shizukuishi discloses the micro-lens array of claim 6, wherein a respective one of said second micro-lenses overlaps surrounding ones of said first micro-lenses

(Shizukuishi teaches 12B overlaps 12G- see first row in figure 1a for example; col.5, lines 5-17).

Regarding claim 11, Shizukuishi discloses the micro-lens array of claim 6, wherein said first, second and third sizes are equal to each other (Shizukuishi teaches the micro lenses are only spectrally differentiated-see col. 11, lines 35-45).

Regarding claim 12, Shizukuishi discloses a micro-lens array, comprising:

a first set of micro-lenses comprising a plurality of first micro-lenses (for example 12G);

a second set of micro-lenses comprising a plurality of second micro- lenses (for example 12B);

wherein said first micro-lenses exhibit different optical transmission properties than said second micro-lenses (see col. 4, lines 3-10).

Regarding claim 13, Shizukuishi discloses the micro-lens array of claim 12, comprising a third set of micro- lenses comprising a plurality of third micro-lenses (for example 12R;see col. 4,lines 3-10).

Regarding claim 14, Shizukuishi discloses the micro-lens array of claim 13, wherein said third micro-lenses exhibit different optical transmission properties than at least one of said first and second micro-lenses (Shizukuishi discloses the each lens receives/transmits a different color band –see col. 4, lines 3-10).

Regarding claim 15, Shizukuishi discloses the micro-lens array of claim 14, wherein said third micro-lenses exhibit different optical transmission properties than both said first and second micro-lenses (Shizukuishi discloses the each lens receives/transmits a different color band –see col. 4, lines 3-10).

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Regarding claim 16, Shizukuishi discloses the micro-lens array of claim 13, wherein said first micro-lenses abut said second and third micro-lenses (see figure 1a for example).

Regarding claims 36 and 39, Shizukuishi discloses a semiconductor-based imager, comprising:
a substrate having pixel cells formed thereon, each with a photo sensor (see col. 6, lines 20-43);
a micro-lens array (12), comprising:

a first set of micro-lenses comprising a plurality of first micro-lenses each having a first size (12B); and

a second set of micro-lenses comprising a plurality of second micro-lenses each having a second size no small than the first (12G- Shizukuishi teaches the lenses are only spectrally differentiated);

wherein said second micro-lenses are each positioned in a space between adjacent said first micro-lenses such that said second micro-lenses contact said first micro-lenses (see figure

Regarding claim 37, Shizukuishi discloses the semiconductor-based imager of claim 36, further comprising a color filter array (9) positioned over said pixel cells-Shizukuishi teaches a color filter can be used with a spectrally differentiated micro lens- see figure 7 for example.

Regarding claim 38, Shizukuishi discloses the semiconductor-based imager of claim 37, wherein said color filter array (9) is positioned between said micro-lens array (12) and said wafer (1).

Regarding claim 43, Shizukuishi discloses the semiconductor-based imager of claim 36, wherein a respective one of said second micro-lenses overlaps (12G) surrounding ones of said first micro-lenses (12B;see figure 1a).

Regarding claim 44, Shizukuishi discloses the semiconductor-based imager of claim 36, wherein said micro-lens array further comprises a third plurality of third micro-lenses each having a third

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size (12R).

Regarding claim 45, Shizukuishi discloses the semiconductor-based imager of claim 44, wherein said first, second, and third sizes are equal (Shizukuishi teaches the micro lenses are only spectrally differentiated-see col. 11, lines 35-45).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 4-5, 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shizukuishi (US 6,734,031) in view of Tokumitsu (US 5,238,856).

Regarding claim 4, Shizukuishi discloses the lens array is only differentiated by a spectral characteristic (transmission of certain wavelengths) and sensitivities of the lens can be adjusted (see col. 11, lines 38-45). Shizukuishi fails to specifically disclose the micro-lens array of claim 1, wherein a focal length of each of said plurality of first micro-lenses is approximately equal to a focal length of each of said plurality of second micro-lenses.

Tokumitsu teaches that the focal depth is dependent upon lens curvature (see col. 6, lines 1-15). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made the focal lengths of the first and second are approximately equal if the lens array curvature is not differentiated.

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Regarding claim 5, Shizukuishi discloses the lens array is only differentiated by a spectral characteristic (transmission of certain wavelengths) in one embodiment but in another embodiment the sensitivities of the lens can be adjusted (see col. 11, lines 38-45). However, Shizukuishi fails to specifically disclose the micro-lens array of claim 1, wherein a focal length of each of said plurality of first micro-lenses corresponds to a first wavelength of light, and wherein a focal length of each of said plurality of second micro-lenses corresponds to a second wavelength of light.

Tokumitsu teaches that the focal depth is dependent upon lens curvature (see col. 6, lines 1-25). Tokumitsu also teaches that adjusting the curvature of the lens to adjust the focal depths of the lens according the wavelength of light (see also col. 5, lines 49-67). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made the focal lengths can differ for the first and second lens to correspond to the different wavelengths, since Tokumitsu teaches this lens design with the abutting micro lens array reduces smear and noise. Regarding claim 8, Shizukuishi discloses the lens array is only differentiated by a spectral characteristic (transmission of certain wavelengths) and sensitivities of the lens can be adjusted (see col. 11, lines 38-45). Shizukuishi fails to specifically disclose the micro-lens array of claim 6, wherein said first, second, and third micro-lenses each have approximately a same focal length.

Tokumitsu teaches that the focal depth is dependent upon lens curvature (see col. 6, lines 1-15). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made the focal lengths of the first, second and third are approximately equal if the lens array curvature is not differentiated. Further, the focal lengths of the lenses would be

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obvious to one ordinary skill in the art, since it is well known optical properties in micro lens design as taught by Tokumitsu.

Regarding claim 9, Shizukuishi discloses the lens array is only differentiated by a spectral characteristic (transmission of certain wavelengths) in one embodiment but in another embodiment the sensitivities of the lens can be adjusted (see col. 11, lines 38-45). However, Shizukuishi fails to specifically disclose the micro-lens array of claim 6, wherein a focal length of each of said plurality of first micro-lenses corresponds to a first wavelength of light, wherein a focal length of each of said plurality of second micro-lenses corresponds to a second wavelength of light, and wherein a focal length of each of said plurality of third micro-lenses corresponds to a third wavelength of light.

Tokumitsu teaches that the focal depth is dependent upon lens curvature (see col. 6, lines 1-25). Tokumitsu also teaches that adjusting the lens curvature to adjust the focal depths of the lens according to the wavelength of light (see also col. 5, lines 49-67). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made the focal lengths of the first, second and third lens correspond to the different wavelengths, since Tokumitsu teaches the lens design with the abutting micro lens array reduces smear and noise. Further, the focal lengths of the lenses would have been obvious to one ordinary skill in the art, since it is well known optical property in micro lens design for color imaging, as taught by Tokumitsu.

12. Claims 28-29, 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hokari (US 5,493,143) in view of Tokumitsu (US 5,238,856).

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Regarding claim 28, Hokari fails to specifically disclose the semiconductor-based imager of claim 24, wherein at least one of said second micro-lenses abuts at least one of said first micro-lenses.

Tokumitsu teaches a color imaging using micro lenses with different curvatures to increase the amount of light entering a photo sensor. The lenses are patterned on the substrate to abut such that first and second lens, which are spectrally different, will contact or overlap (see col. 5, lines 25-65 and col. 6). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Hokari, as taught by Tokumitsu, since Tokumitsu teaches a patterning method for forming the micro lenses without wasteful gaps on the substrate and such design in color imagers allows for a reduction in smear and its related noise.

Regarding claim 29, Hokari fails to specifically disclose the semiconductor-based imager of claim 24, wherein a respective one of said second micro-lenses overlaps surrounding ones of said first micro-lenses.

Tokumitsu teaches a color imaging using micro lenses with different curvatures to increase the amount of light entering a photo sensor. The lenses are patterned on the substrate to abut such that first and second lens, which are spectrally different, will contact or overlap (see col. 5, lines 25-65 and col. 6). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Hokari, as taught by Tokumitsu, since Tokumitsu teaches a patterning method for forming the micro lenses without wasteful gaps on the substrate and such design in color imagers allows for a reduction in smear and its related noise.

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Regarding claim 35, Hokari fails to specifically disclose the semiconductor-based imager of claim 33, wherein at least one of said first micro-lenses abuts at least one of said second micro-lenses and at least one of said third micro-lenses.

Tokumitsu teaches a color imaging using micro lenses with different curvatures to increase the amount of light entering a photo sensor. The lens are patterned on the substrate to abut such that first, second and third lens which are spectrally different will contact or overlap (see col. 5, lines 25-65 and col. 6). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Hokari, as taught by Tokumitsu, since Tokumitsu teaches a patterning method for forming the micro lenses without wasteful gaps on the substrate and such design in color imagers allows for a reduction in smear and its related noise.

13. Claims 40-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shizukuishi (US 6,734,031) in view of Hokari (US 5,493,143).

Regarding claims 40-41, Shizukuishi discloses the semiconductor-based imager of claim 36. Shizukuishi discloses the lens array is only differentiated by a spectral characteristic (transmission of certain wavelengths) and sensitivities of the lens can be adjusted (see col. 11, lines 38-45). Shizukuishi fails to specifically disclose the micro-lens array of claim 36, wherein said first and said second micro-lenses each exhibit a similar focal length.

Hokari teaches the spectrally and size differentiated lens wherein said first (blue) and said second micro-lenses (green) each exhibit a similar focal length (see figure 9- each focus at the photo sensor-see also col. 5, lines 15-65). Thus, it would have been obvious to one of ordinary

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skill in the art at the time the invention was made to have the lenses exhibit similar focal lengths, as taught by Hokari, to insure the light is collected at the sensor and not at other places within the imager- i.e. the thickness of the layers between the lenses and photo sensor are typically at a constant thickness/depth, as exhibited in figure 9.

Regarding claim 42, Shizukuishi fails to specifically disclose the semiconductor-based imager of claim 36, wherein a focal length of the plurality of first micro-lenses is adjusted for a first color signal, and wherein a focal length of the plurality of second micro-lenses is adjusted for a second color signal.

Hokari teaches the spectrally and size differentiated lens wherein said first (blue) and said second micro-lenses (green) each exhibit a similar focal length (see figure 9- each focus at the photo sensor-see also col. 5, lines 15-65). Hokari also teaches the curvature for each lens is differentiated. This is the functional equivalence for adjusting the focal length. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the focal length for the different spectral wavelengths, since Shizukuishi teaches adjusting the lens and Hokari further teaches adjusting the curvature and layer thickness to focus light onto the sensors to improve color balance.

Conclusion

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alicia M Harrington whose telephone number is 571 272 2330. The examiner can normally be reached on Monday - Thursday 9:30-6:00.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Georgia Epps can be reached on 571 272 2328. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


AMH

Alicia M Harrington
Examiner
Art Unit 2873